

**RHIC Operations Procedures Manual
AGS Operations Procedures Manual**

**RHIC OPM 2.4
AGS OPM 2.5.2
RHIC OPERATION SAFETY LIMITS/ACCELERATOR SAFETY ENVELOPE**

Text Pages 1 through 7

Hand Processed Changes

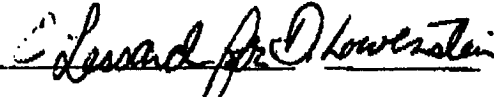
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RHIC OPM 2.4
AGS OPM 2.5.2
RHIC Operational Safety Limits/Accelerator Safety Envelope

1.0 Purpose

This procedure defines the Operational Safety Limits for the RHIC Complex during Commissioning Without Beam, STAR and PHENIX operation, and for the RHIC complex under AGS Conduct of Operations during Commissioning with Low Intensity Beam in order to provide workplace safety, protect the environment and comply with applicable federal, State and local requirements. The Operational Safety Limits and the Accelerator Safety Envelope are equivalent concepts as indicated in 1.1 and 1.2.

- 1.1 The Accelerator Safety Envelope (ASE) is a set of physical and administrative bounding conditions based on safety considerations approved by the Department of Energy as required by DOE O 420.2 paragraph 4.b.1 and 4.b.2. The ASE provides specific boundaries within which the accelerator and experiments must operate to provide protection to workers, the public and the environment. The technical basis for the ASE is provided in Chapter 4 of the RHIC SAD.
- 1.2 Implicit in the notion of an ASE is that variations in operating conditions are permitted if and only if they do not exceed the defined boundaries. A variation beyond the boundaries described below shall be treated as a reportable occurrence, as defined by DOE O 232.1A

2.0 Responsibilities

- 2.1 The RHIC Project Director and AGS Department Chairman shall approve all changes to the Operational Safety Limits (OSLs).
- 2.2 The On-Duty Operations Coordinator shall follow OSLs A, B, E and F. The Head of Operations shall obtain written confirmation for any deviation from the RHIC Project Director and AGS Department Chairman.
- 2.3 The RHIC Safety Systems Section Head shall follow the OSL C and shall obtain written confirmation for any deviation from the RHIC/AGS Radiation Safety Committee and RHIC Accelerator Systems Safety Committee, as appropriate. Bypass of PASS shall be in accordance with RHIC/AGS OPM 4.92.

- 2.4 The Cryogenic Shift Supervisor and On-Duty Operations Coordinator are responsible to supervise the implementation of OSL D, during period without beam and with Low Intensity beam, respectively. The Work requestors are responsible to obtain Work Permits.
- 2.5 The Cryogenic Shift Supervisor shall follow OSL G. No deviations are permitted.
- 2.6 The STAR Shift Leader is responsible for OSL H.
- 2.7 The PHENIX Shift Leader is responsible for OSL I.

3.0 Prerequisites

None

4.0 Precautions

None

5.0 Procedure

Operational Safety Limits have been established for:

- A. COLLIDER BEAM INTENSITY
- B. BEAM LOSSES AND AREA CLASSIFICATIONS
- C. PARTICLE ACCELERATOR SAFETY SYSTEM
- D. OXYGEN DEFICIENCY HAZARD CONTROL
- E. FIRE PROTECTION
- F. MAIN CONTROL ROOM STAFFING
- G. CRYOGENIC CONTROL ROOM STAFFING
- H. STAR
- I. PHENIX

A. COLLIDER BEAM INTENSITY LIMIT

The following requirements take into the consideration the RHIC Design Criteria for Prompt Radiation and compliance with 10 CFR 835 and DOE O 5400.5:

1. The maximum number of particles in each ring shall not exceed the equivalent 2.85×10^{10} Au ions at 100 GeV/u. This loss at a point corresponds to approximately 14 mrem on top of the typical berm in an uncontrolled area.
2. The beam loss at a point under an uncontrolled area shall not be permitted to exceed 10^{10} equivalent Au ions at 10.4 GeV/u in an hour. This loss corresponds to an estimated 0.5 mrem.
3. The loss on the W-Line Beam Stop shall be limited to the equivalent of 1.53×10^{14} Au per year at 10.4 GeV/u. This loss limits the concentration of induced radioactivity in soil and groundwater.

B. BEAM LOSSES AND AREA CLASSIFICATIONS

The location of beam losses determines access restrictions as specified in Appendix 1 of the RHIC Safety Assessment Document. Thompson Road, Ring Road, roads to and from Ring Road, unfenced portions of the berm and the Collider Center (Building 1005S) shall be maintained as Uncontrolled Areas.

C. PARTICLE ACCELERATOR SAFETY SYSTEM

The Laboratory requires that all personnel safety interlocks for catastrophic and critical systems must functionally tested before use of the process system and every six months thereafter. Management may approve a grace period of up to two months.

1. The safety system shall be operational and functionally tested every six months. ODH monitors and ODH ventilation fans shall be functionally tested every six months.
2. Area radiation monitors shall be calibrated annually, and the interlock portions shall be functionally tested every six months.
3. For proton beam extraction in the AtR, the AGS beam current monitors must be operational and functionally tested or equivalent protection shall be provided via Radiation Safety Lockout/Tagout (RS-LOTO) at the proton injection system.

4. Heavy ion beam is limited in intensity with respect to high intensity protons. Heavy ion beam operation is permissible, if the AGS beam current monitoring system is unavailable.

D. OXYGEN DEFICIENCY HAZARD CONTROL

Due to the decrease in density of helium at 50 K versus normal operation of the Collider at 4.6 K, a release of helium would result in only 10% of the effect at 4.6 K. The oxygen concentration will not go below the OSHA requirements in the event of a loss of helium.

Work in the Collider Tunnel is permitted without PASS in operation to control access, ODH alarms and emergency ventilation. Prior to conducting a test to verify that a release of 55 K helium will not create an ODH hazard above the eight foot elevation, work above that height will be controlled by a Work Permit and monitoring by a Personal Oxygen Monitor (POM). Deletion of work controls will be contingent on a favorable test outcome.

When the temperature of the helium in the Cryogenic System is less than or equal to 50 K, the Collider shall be placed on Restricted Access, in conjunction with the associated training and access control procedures. Work above eight feet will be controlled by a Work Permit and monitoring by a POM until a determination is made on OSHA compliance. Deletion of work controls will be contingent on the determination.

E. FIRE PROTECTION

The on-duty Operations Coordinator shall take appropriate action, if notified by the BNL Fire/Rescue Group that fire detection/protection systems are impaired. These actions may either be to prohibit personnel from working in a specific area and/or to de-energize equipment.

F. MAIN CONTROL ROOM STAFFING

To restrict operation to an adequate number of qualified personnel in the Main Control Room, as a minimum, one Operations Coordinator and one Operator shall be on duty when beam is in operation.

G. CRYOGENIC CONTROL ROOM STAFFING

When the refrigerator is in operation a watch must be provided in the Cryogenic Control Room, preferably the Shift Supervisor, but qualified Cryogenic Operators can designated by the CSS to be the sole watch stander.

One Cryogenic Shift Supervisor (CSS) or his/her designee, shall remain in the Cryogenic Control Room at all times. Any work in the field on the cryogenic system shall be in accordance with a two-person rule as required by RHIC SEAPPM 1.16.0.1.

H. STAR

Items 1 and 2 minimize the fire and explosion hazards to personnel, equipment and the program.

1. Introduction of flammable gas into the integrated detector positioned in the IR:
 - a. Flammable gas detection shall be operational and functionally tested.
 - b. Ventilation through the detector shall be functioning and functionally tested, and
 - c. One of the two emergency exhaust fans shall be in service and functionally tested.
 - d. The quantity of purge gas shall be maintained to dilute the detector flammable gas volumes below 25% of the LEL. The volume varies by subsystem and is dependent upon the gas mixture currently in use. The operational requirements shall specifically be defined in the Operating Procedures for the detector.
 - e. The TPC gas used in the detector shall be P-10 or equivalent hazard.
 - f. When the TPC is in operation, no more than 80 cubic meters of methane gas shall be attached to the gas mixing system.
 - g. When flammable gas is introduced into the detector, a qualified local watch shall be provided.
2. In order for the electronics to be powered as an integrated detector in or out of the IR, the Highly Sensitive Smoke Detection (HSSD) system on the detector or the ceiling-level HSSD system shall be operational and functionally tested.

I. PHENIX

Items 1, 2 and 3 minimize the fire and explosion hazards to personnel, equipment and the program.

1. Introduction of flammable gas into the integrated detector positioned in the IR:
 - a. Flammable gas detection shall be operational and functionally tested.
 - b. Purge air flow to each powered electrical cabinets shall be maintained.
 - c. IR ventilation shall be operational.
 - f. Equipment ventilation shall be functioning through the respective operational portions of the detector.
 - g. Emergency exhaust ventilation shall be in service and functionally tested.
 - h. The interstitial space between the RICH and the Pad Chamber FEE shall be inerted before introduction of flammable gas to the RICH.
 - i. Flammable gas shall not be used in the RICH until the FMEA is approved by the ESC.
 - j. When flammable gas is introduced into the detector, a qualified local watch shall be provided.
2. In order for the electronics to be powered in the integrated detector:
 - a. The electrical interlocks used for personal protection interlocks shall be operational and functionally tested as part of PASS.
 - b. The Highly Sensitive Smoke Detection (HSSD) system on the detector or the ceiling-level HSSD system shall be operational and functionally tested.
3. The quantity of purge gas shall be maintained to dilute the detector flammable gas volumes below 25% of the LEL. The volume varies by subsystem and is dependent upon the gas mixture currently in use. The operational requirements shall specifically be defined in the Operating Procedures for the detector.

4. Compliance with the Life Safety Code requirements: In order for the IR to be occupied by personnel after flammable gas has been introduced, the personnel plug door and the emergency escape labyrinth shall be available for egress.

6.0 Documentation

None

7.0 References

None

8.0 Attachments

None